Section 1
Overview

System Overview 1.1

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Introduction

The Apricot Portable is a radical new approach in the design of a microcomputer. The whole machine reflects a major departure from the traditional standard microcomputer in terms of features, electronics design and styling.

The Portable is a "true" transportable business microcomputer, weighing in at less than 15 lbs and with a comparatively small footprint.

The lightness and compact design of the machine has not detracted in any way from the electronic specification of the machine which is far more advanced than the majority of stand-alone micros currently on the market.

Besides possessing the major innovative feature of an integral high resolution flat panel display, instead of the ubiquitous CRT monitor, it also incorporates all the standard features found in most of the currently available stand-alone micros:

1. Parallel printer interface.
2. Asynchronous and synchronous RS232 communications capabilities.
3. Complex sound generation facilities.
4. Expandability (using all the current ACT Expansion boards - RAM boards, Modem, Winchester Controller, LAN Board etc).
5. Low profile professionally styled Keyboard with QWERTY typewriter layout, calculator keypad and function keys.

Other features which make the Portable stand out from todays' crowd of business micros are the hardware/software integration of:

1. An advanced Voice Input System (VIS). This is an extremely sophisticated speech recognition system which enables the applications programmer/user to configure his software to be driven by voice.
2. Multi-purpose display driver architecture. This can be software configured for a number of different resolutions and modes. It even provides the programmer with the facility to drive both the flat panel display and an optional colour monitor with different data and thus produce two different displays simultaneously.

Instead of being linked to the Systems Unit by a cable, the Keyboard uses an infra-red link for transmission of keycodes and other data (time and date information, hardware reset, etc). Multiple machine environments where infra-red interference could occur from other users is catered for by the use of a "light-pipe". This acts as a transmission line which directs the infra-red between the Keyboard and its parent Systems Unit.

Details

Packaging and Styling

The Apricot Portable is composed of two main sections as previously mentioned; the Systems Unit and the Keyboard (see Figure 1).

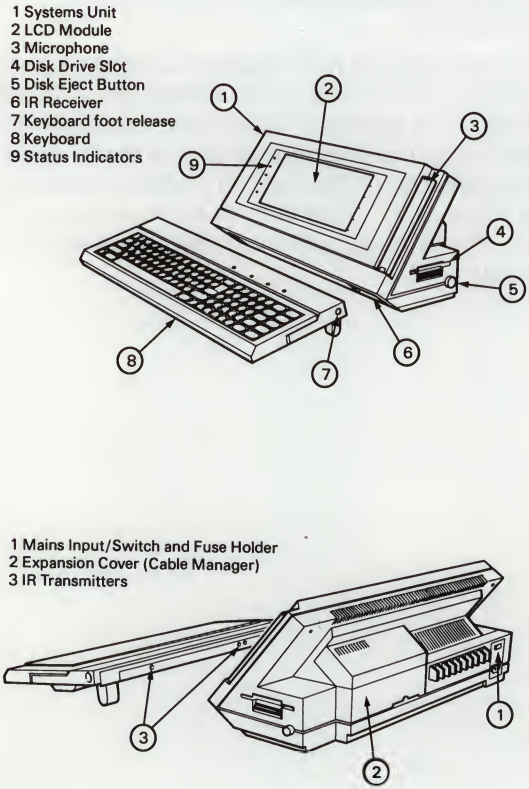

Figure 1. Apricot Portable

The Systems Unit houses the majority of the control electronics, including the processing system and interfaces for;

1. The various display technologies.
2. Infra-red keyboard/mouse data.
3. Voice input.
4. Printers/plotters and similar devices.
5. External communications equipment.
6. Sound Generation.

It also contains the integral high resolution flat panel Liquid Crystal Display (640 x 200 dot LCD) which is capable of displaying 25 lines of 80 characters, a microphone for the voice input circuitry, the system RAM, a double-sided MicroFloppy disk drive, a power supply and a loudspeaker.

The Keyboard consists of a standard QWERTY typewriter section plus calculator keypad (with an identical key top layout to the Apricot pc/xi range of products), a block of 10 "fixed/ programmable" function keys, and four recessed keys which perform specific fixed functions. It also includes:

1. Four AA batteries which form the power source for the keyboard electronics.
2. A processing system which provides the interface between the keys and the infra-red transmission circuitry.
3. A real time clock/calendar.

The desktop area (commonly called the footprint) occupied by the two sections has been optimised to avoid the perennial problem facing most microcomputer users, of excessive desk clutter. A comparison of the footprints of the Systems Units of other portable manufacturers illustrates the desk space saving afforded by the Apricot Portable.

IBM Portable PC	:	17 x 20 inches
Compaq Portable	:	16 x 20 inches
Apricot Portable	:	17.5 x 7 inches

Freedom of user desk space was also one of the criteria for using an infra-red cordless link between the Keyboard and the Systems Unit. This provides the user with a much greater flexibilty in positioning the Keyboard relative to the Systems Unit as compared with the standard cable link approach.

The flat panel display is physically mounted within the housing of the Systems Unit at a fixed angle. This was calculated by the designers to provide the optimum viewing position for the "average person" when sitting normally at a desk, with an overhead light source.

Since the majority of people generally do not fall into the "average" category and even the "average persons" requirements occasionally differ, the display viewing angle can be adjusted electronically under software control. (The actual method of adjusting the viewing angle is achieved by altering a control voltage supplied to the display module, which varies the polarisation of the display crystals relative to the module housing:- producing an equivalent effect to tilting the display relative to the viewer).

The viewing angle adjustment is available to the user immediately following system boot-up, by using the CONTROL key plus CURSOR UP and CURSOR DOWN keys.

Holding the CONTROL key down and repeatedly pressing the CURSOR UP key adjusts the viewing angle towards the vertical. Holding the CONTROL key down and repeatedly pressing the CURSOR DOWN key adjusts it for viewing the display from a more horizontal position.

The viewing position of the display is also dependant on two other factors. These are:

1. The positioning of the ambient light used to illuminate the display.
2. Temperature variations.

Variations from the original design criteria of overhead lighting can be compensated for by a combination of correct positioning of the light source relative to the machine and using the keyboard viewing angle adjustment.

The sensitivity of the display to temperature is such that variations of 5 degrees C will produce changes in the orientation of the display crystals with the result that the viewing angle will also require changing. This can also be compensated for by using the Control/Cursor key adjustment.

Seven LED indicators are located on the front of the Systems Unit, six on the left-hand side of the flat panel display. one on the right. These provide the user with indications of various states within the machine, as specified by the associated indicator legend. The indicators are normally illuminated to show the following states:

Stop	STOP key is active.
Caps	CAPS LOCK key is active.
Shift	Keyboard is set into the Shifted Mode (normally obtained by depressing the keys - CONTROL and CAPS LOCK together).
Disk	The disk within the disk drive is being written to or read from.
Colour Select	The Portable is set to direct screen output to the optionl colour monitor.
Voice	The speech recognition software is active.
Power	The machine is switched on.

The microphone for the Voice Input System is located on the right-hand side of the flat panel display. It is designed to be used in either one of two modes of operation.

The microphone housing is fitted with a hinge which allows it to be angled forward from its storage position to point in the general direction of the user. This is the first mode.

Alternatively, it can be "hand held". The microphone cable is a curly coil cable approximately 1 metre long and is plugged into a jack socket on the left-hand side of the machine.

Connections for a printer, the optional colour monitor and external communications equipment are all located behind the removable Expansion cover on the back of the Systems Unit. The cover is removed by simply inserting a flat-bladed screwdriver into the removal slots and twisting it slightly to unhook the retaining clips.

Removing the cover also allows user access to the single Expansion Slot which is electrically and physically compatible with all the current ACT Expansion Boards.

Cut-outs are provided in the Expansion cover to allow cables (for the printer, communications equipment, etc) to be neatly and tidily routed out of the back of the unit.

The mains switch is also located on the rear of the unit. This is part of a combined mains switch/fuse holder module. The fuse is located behind a hinged flap on the switch module housing.

A mains changeover switch is located on the base of the Systems Unit to cater for the two standard mains operating voltages used throughout the world. This allows the Portable to be reconfigured for either 110V or 240V operation by simply changing the position of the changeover switch. (The fuse is rated to cope with either operating voltage).

To meet the desirable goal of quietness of operation, the Portable does not employ a fan for cooling (the major noise source on most other business micros). Instead, cooling is provided by the natural airflow created in and around the machine by the positioning of vents in the case relative to the internal components which generate most of the heat.

Portability

As the name given to the machine indicates, it has been specifically designed to be easily transported. To this end, the size of the Portable has been kept as compact as possible and the weight minimised without compromising on features and facilities.

The total weight of the Systems Unit and the Keyboard has been kept to less than 13 lbs to retain a realistic manageable carrying weight. (c.f. Some of the current crop of heavyweight portable micros: IBM Portable PC - 30 lbs; Compaq Portable - 28 lbs).

To allow safe and easy transportation of the Portable, a carry-case is provided which is approximately the size of a standard briefcase. The case is manufactured from a rigid plastic material and has been specifically designed to protect the Keyboard and Systems Unit from general everyday wear and tear during transit.

Other compartments, besides the space for the Systems Unit and Keyboard, are included in the case to take the cables, the User Manuals and one of the optional items available for the machine. This allows the user to carry either the Portable infra-red Mouse or the optional thermal printer inside the carry case.

Prior to transportation, a packing disk should be inserted into the Portable's disk drive as a safety measure. This is necessary to avoid the possibility of excessive vibration causing damage to the disk drive heads.

Processing Capability

The Portable employs the Intel 8086 as the main central processing element and a discrete DMA controller for performing fast data transfers (between disk controller and memory, memory to memory).

The features of the Intel 8086 are well known, being a true 16-bit processor, supported by the two major microcomputer operating systems companies (Microsoft with MS-DOS, Digital Research with CPM-86 and Concurrent DOS), and possessing:

1. 16-bit wide internal register architecture.
2. 16-bit wide external data bus.
3. Segmented addressing structure to support modular programming.
4. The capability of addressing up to 1 Mbyte of memory space and up to 64 Kbyte of system I/O.

The processing system operated on the board is a real time interrupt driven system, based upon the interrupt structure provided by the 8086 and a programmable interrupt controller. The interrupt controller performs all the duties of an interrupt manager/arbitrator, generally making the decisions to determine which hardware-driven process requires servicing by the 8086. The decisions are made on an assigned priority basis.

Peripheral support for the 8086 is provided by a mixture of intelligent support chips and combinations of simpler standard logic elements.

The intelligent support chips include:

1. A Western Digital WD2797-02 Floppy Disk Controller for controlling the MicroFloppy Drive.
2. A Zilog Z80 SIO/0 which interfaces to the RS232C port and also receives data from the infra-red keyboard link.
3. An Hitachi 6301 8-bit processor for handling voice input.
4. A Motorola 6845 CRTC for accessing the display memory and generating video timing (for the colour display circuitry).
5. A custom LCD driver IC for accessing the display memory, processing of data sent to the flat panel display and display timing.
6. An Intel 8253-5 programmable interval timer which acts as a general system timer and also determines the baud rates for the RS232C port.

Another processor is located within the Keyboard. This is a NEC 7507 4-bit processor. It is employed to perform keyboard scanning, encoding of detected keys into a suitable format for transmission via the infra-red link, and the implementation of a real time clock/calendar.

Memory

The machine is fitted with a minimum of 256 Kbyte of system RAM (using 64K DRAMs) and is expandable using one of two methods; either by fitting one of the standard Apricot RAM expansion boards (128K, 256K or 512K RAM Expansion boards) into the Portable Expansion Slot or via on-board memory expansion (supplied as a manufacturing option).

The on-board option allows the Portable system memory to be upgraded to 512 Kbytes. This is achieved by fitting 256K DRAMs instead of the standard 64K DRAMs, during the manufacturing process.

Other areas of memory included in the Portable are the Boot ROMs and the display memory.

The Portable's Boot ROMs contain a great deal more code than the original Apricot pc/xi machines. Instead of just containing a bootstrap loader, diagnostics, calculator, and a rudimentary screen handler (as with the original disk-based BIOS machines of the Apricot pc/xi range), the majority of the BIOS has been incorporated within ROM on the Portable.

This includes all the device driver routines for handling the standard hardware devices of the Portable (screen, keyboard, disk drive, parallel port, serial port, etc - see Software Chapter following).

Producing a ROM-based BIOS for the Portable has the major advantage over disk-based BIOS machines of not occupying valuable code space in the system RAM which could be otherwise utilised by applications software.

The Portable is fitted with two 16K x 8 bit ROMs to store the ROM-based BIOS (i.e. 32 Kbytes of code space). The board containing the memory is also tracked to take 32K x 8 bit ROMs to allow for future BIOS expansion.

Another feature of the Portable which also in effect "frees" more system memory for the applications programmer, is the use of a separate area of display memory instead of dual-porting the system RAM.

In the base model of the Apricot Portable range, the display memory is formed by eight 16K x 4 bit DRAMs. This is sufficient memory to drive the flat panel display and a colour monitor in either a two-colour (LCD on), or a four-colour mode (LCD off).

The second model in the range incorporates the colour option circuitry, which is obtained by fitting an extra 64 Kbytes of DRAM to the Portable's internal circuitry. This is implemented by plugging in another eight 16K x 4 bit DRAMs. (The circuit board containing the display hardware is tracked to do this).

The extra memory provides applications software with sufficient memory capacity to drive the flat panel display and an optional colour monitor using up to eight colours with the flat panel on or 16 colours if the LCD is off (see the Display Features section later on in this chapter for more details). The selected mode determines how much of the display memory is utilised.

The 128 Kbyte of display memory and the PROMs are mapped above 832K in the 1 Mbyte address range of the 8086 processor. The top 64K of the memory space is reserved solely for the Boot ROMs.

Disk Drives

The Portable incorporates a single integral MicroFloppy Disk Drive which is format compatible with all the other computers within the Apricot range of products.

The disk drive slot is located on the right hand side of the Portable. A disk eject button is provided to ensure swift and easy removal of disks.

The disk drive is a Sony double-sided MicroFloppy which uses 3.5 inch disks with a formatted storage capacity of 720 Kbytes of data.

The double-sided MicroFloppy disks contain 80 tracks per side, and are soft sectored with 9 sectors per track and 512 bytes per sector. The software format is a logical derivation of the IBM system 34 format for 8 inch disks and is common to all the MicroFloppy based products in the Apricot range (i.e. both the 70 track single-sided and 80 track double-sided disk drive based machines).

BIOS support is provided within the Portable to allow single-sided 70 track MicroFloppy disks to be read from, written to and formatted within the Portable's 80 track double-sided drive.

The Portable can also be easily upgraded into a Winchester based machine, using the Apricot MSD (Mass Storage Device) option. This consists of a pre-formatted 10 Mbyte Winchester Disk Drive, a Winchester Controller Board and a separate Power Supply Unit. The controller board fits into the Portable's Expansion slot. Both the 10 Mbyte drive and Power Supply are positioned externally to the Portable.

Support for the Winchester Disk Drive is also incorporated within the standard BIOS to allow the user to access the extra storage space.

Display Features

The design of the display circuitry of the Apricot Portable is slightly different from the usual microcomputer display architecture.

The first major difference is that the Portable is able to drive two different display technologies; the integral flat panel display (LCD module) and an external colour monitor simultaneously.

The second major difference is that the hardware is totally software configurable for different modes and resolutions. For example, the base model of the Portable range can be configured to drive a colour monitor with any number of scan lines up to a maximum of 400 and also have the capacity to display up to 4 colours on the monitor. The limiting factor is the capability of the monitor itself.

The third major difference is that there is no hardware differentiation between text and graphics; everything is pixel-based. i.e. A "dot" on the display screen (flat panel or colour monitor) is mapped by a corresponding bit(s) in the display memory.

In other words, it does not matter whether the Portable is displaying text or graphics, the display circuitry treats them both in an identical manner. This feature of the design makes it easier for the programmer to mix text and graphics as required by more and more integrated text and graphics based applications and window orientated operating systems.

The base model of the Portable range is fitted with sufficient display RAM to:

1. Drive the LCD module and a colour monitor (using any two colours from 16).
2. Drive the colour monitor using any four colours from 16.

The second model within the range is fitted with sufficient display memory to:

1. Drive the LCD module and a colour monitor (using any eight colours from 16).
2. Drive the colour monitor using the full 16 monitor colours.

The resolution of the LCD module is fixed at 640 pixels wide by 200 pixels high. This is bit-mapped by a screen image located in an area of the display memory. The resolution is such that it allows the programmer to display the industry standard of 25 lines of text with 80 characters in each line, using characters formed in a 7 x 7 pixel matrix and contained in an 8 x 8 pixel cell. The bit-map is a linear array of bytes in the display RAM, and thus easily allows the programmer to mix text and graphics.

A default font of 128 characters (based within an 8 x 8 pixel cell) is contained in the system ROM. Each character is mapped by eight contiguous bytes in the ROM. A default font of 256 characters (also based within an 8 x 8 pixel cell) is loaded into the system RAM at boot-up. Support in the BIOS also allows user-defined fonts to be installed within the system RAM. These can be easily accessed by simply modifying a font pointer.

All the standard character attributes are available to the programmer for displaying text on the LCD. These are produced by direct bit manipulation of the character image in the display RAM. Both normal and reverse video characters are supported with any combination of the following attributes:

1. Underline.
2. Strikethrough.
3. Intensity (simulated by shadow printing).

Sufficient space is provided in the display RAM to allow a second image of the flat panel display to be stored. This can be switched onto the LCD under software control instead of the first image. As this feature allows fast display changes, it is particularly useful for applications, for example, that use Help menus.

The colour modes, resolutions and display features available to the programmer provided by the colour display RAM are detailed in the next two paragraphs. The resolutions described match the resolutions of the current ACT colour monitors.

For USA usage and other countries using 60 Hz mains supply frequency:

Base Model

1. 640 x 200 bit-mapped colour graphics using 2 colours + 640 x 200 bit-mapped LCD.
2. 640 x 200 bit-mapped colour graphics using up to 4 colours, LCD off.

Variant

3. 640 x 200 bit-mapped colour graphics using up to 8 colours + 640 x 200 bit-mapped LCD.
4. 640 x 200 bit-mapped colour graphics using up to 16 colours, LCD off.

For UK, European and other countries using 50 Hz mains supply frequency:

Base Model

1. 640 x 256 bit-mapped colour graphics using colours + 640 x 200 bit-mapped LCD.
2. 640 x 256 bit-mapped colour graphics using up to 4 colours, LCD off.

Variant

3. 640 x 256 bit-mapped colour graphics using up to 8 colours + 640 x 200 bit-mapped LCD.
4. 640 x 256 bit-mapped colour graphics using up to 16 colours, LCD off.

These are not the only resolutions able to be supported by the Portable. With the availability of a suitable high resolution colour monitor, the Portable can be configured to operate in the two basic colour modes (8 colours + LCD or 16 colours, no LCD) with a line resolution up to a maximum of 400 lines.

In the colour modes, the programmer can select any combination of colours from sixteen standard colours using a colour palette. The palette is an area of I/O mapped RAM which determines the colour mix at the display outputs.

For example in the eight colour mode, the programmer can select any combination of eight colours from 16. In the two colour mode, he can select any two colours from sixteen, etc.

A second default font of 256 characters (7 x 9 characters based within an 8 x 10 pixel cell) is down loaded into the system RAM at boot-up. This is designed to be used with the 256 line display modes. Each character is mapped by ten contiguous bytes in the RAM.

Support in the BIOS also allows other 8 x 10 cell user-defined fonts to be installed within the system RAM. These characters can also be easily accessed by simply modifying a font pointer. The 8 x 10 based font is of a greater resolution than the 8 x 8 based font for the 200 line modes but is of an identical 256 character set. The basic difference is in the construction of the characters, with lower case letters generally having longer descenders.

To obtain a sensible and usable "text mode" on the colour display for existing text based applications, the attribute support by the BIOS is only allowed in monochrome on the colour monitor (i.e. any two colours from the possible sixteen).

This allows the programmer to assign the same software character attributes to the colour monitor as to the LCD (normal and reverse video characters with any combination of; Underline, Strikethrough, Intensity). These are produced in exactly the same manner as for the LCD; via direct bit manipulation of the character image in the display RAM.

BIOS support for character attributes are not provided in the multi-colour modes due to the inherent nature of the colour display itself. Since the only effect an attribute is used for is to differentiate a character(s) from other characters, any of the standard attributes can easily be represented by assigning attributes to a different colour in a multi-colour mode, instead of the normal monochrome method.

Voice Input System

The hardware of the Voice Input System (VIS) consists of the microphone and an integral signal conditioning circuit which uses its own dedicated processing system. This is based upon a 6301 single-chip microcomputer.

The function of the VIS is to provide the user with another way of communicating with the Portable in addition to Keyboard and Mouse. It enables the user/application writer to configure the computer to respond to spoken words and phrases.

The speech recognition part of VIS is largely implemented by software algorithms and has been fully integrated into the MS-DOS environment. The 6301 based processing system performs all the low level operations of analysing and transferring the incoming speech data to the system software.

Linking it into the operating system environment has the added advantage of allowing both users and applications to easily utilise the speech recognition facility provided by VIS.

The VIS is a speaker dependent voice recognition system. It allows the user to 'train in' a vocabulary of isolated words or phrases into the computer, and then use these within an application or at the operating system level to command the computer to perform specific actions.

The VIS can be easily switched on and off using the keystroke combination SHIFT + F5 (VOICE key). An LED on the front panel (Voice) is illuminated to indicate that the recognition software is switched on.

There are two different methods of using VIS.

The first method is where the application has no knowledge of voice input, and thus programs like Supercalc, WordStar, and even the operating system, can be utilised with the speech input facility without any alteration.

An example of this method is where a number of the WordStar commands (e.g. BLOCK, ON-SCREEN, QUICK, etc) are implemented for voice input.

Normally an application would configure function keys on the keyboard to activate these commands, and the method is therefore called the *Voice Function Key* method of using the VIS. The user is able to speak these commands at any time during the execution of Wordstar and activate the relevant operation as though the key had been pressed.

This method can be applied to any application which uses the keyboard as its standard method of input.

The second method is where an application has complete knowledge of the VIS.

An example of this is where an application interacts with the VIS to provide a highly interactive speech recognition interface (such as found in the ACT application, Diary which is supplied as a standard piece of software with the Portable).

The integration of speech recognition facilities into the application is the method by which best results are obtained. To facilitate this integration, ACT has provided a set of routines which hides the complexity of speech recognition, and allows an applications writer to utilise the functions of VIS to the fullest.

This method of using the VIS is termed the *Voice Driven Application* mode.

What the Voice Function Key mode allows the user to do is to configure an existing application or even the operating system environment to respond to voice input.

The way this is implemented is by using a simple utility (TRAIN). It allows the user, a software distributor, or dealer to utilise the VIS for voice function keys.

This utility enables the creation of a vocabulary, speaker training, and the linking of the vocabulary into the operating system.

A second utility program (VOICE.EXE) allows the user to load the vocabulary file prior to loading the application. The vocabulary loader performs the following functions:

1. Enables the VIS and the VOICE key on the keyboard to be initialised to the "off" state.
2. Loads the trained word models (profiles) into memory and informs the VIS of their presence.
3. Loads the key-codes associated with the word models into memory.

The format for loading the vocabulary file is as follows:

A>VOICE <filename> 32

32 indicates the size of the vocabulary. In the Voice Function key mode, the VIS limits the user to a maximum vocabulary of 32 words.

The voice training program creates word-profiles of particular words or phrases that are spoken to the computer. It stores them along with the actions that the computer is to take when these word-profiles are recognised by the VIS.

The word-profiles, and information about how the computer handles them, are stored in a vocabulary file. The vocabulary filename is always suffixed by the extension ".VOC".

The voice training program controls all aspects of the creation, amendment, deletion and training of complete vocabulary files or individual vocabulary records (word-profiles plus command information).

The file has two parts, being the parameter information and the vocabulary records.

The parameter information tells the voice recognition program about the expected environment that this vocabulary is to be used in; for example the sex of the speaker and the amount of background noise.

The vocabulary records contain the word-profile, the command or text to be sent to the keyboard input buffer when the word or phrase is spoken, and a prompt for repeating the word in the training session.

For example, if the user wishes to configure the VIS to be used within the MS-DOS environment and to respond to the word "DIRECTORY" to provide a list of all the files on the disk, the prompt used would simply be the word DIRECTORY, and the command would be "DIR".

When the recognition program hears the word, it sends "DIR" (the command) to the keyboard input buffer.

As the VIS is not 100% perfect at its job it will sometimes misrecognise a word or not hear it. In the first instance the application would perform the wrong function and in the second the user would have to say the word again.

When one voice function key is confused with another the application could perform a dangerous operation. (e.g. a DELETE operation). This problem occurs as the user does not have to confirm that the word the VIS recognises is the one he said.

With the Voice Driven Application as described in the next few paragraphs, this is not a problem as the application need not perform the required operation until the user confirms it. This is exactly the same situation as in most situations where typing carriage return at the end of an input signifies "action the command".

A Voice Driven Application is one where the application interacts directly with the features of the VIS. The ACT Diary is such an application which is provided as standard software with the Portable.

The major difference between the Voice Function Key mode and the Voice Driven Application mode, is that in the application mode, the application is totally aware of the VIS. This makes it a great deal more flexible in terms of features and functions.

It provides the user with a much more interactive and friendly interface which is also tolerant to misrecognition by the VIS and as a result less prone to operational errors.

If the application fails to recognise the word, it will either ask the user to repeat the word, or ignore it completely. If the application is commanded to do a critical operation, which if not meant by the user could result in a catastrophic loss of information, the command is not actioned immediately. The user is asked to confirm the command before it is carried out.

The application mode sequence of speech input usually asks for confirmation before any action is taken. That is to say, the application can prompt the user to build up a sentence or phrase on the screen and then confirm it by saying (for example) "OK" before any action is performed.

For example, in the ACT Diary, the user can say

"OPEN-AT" pause "NEXT" pause
"FRIDAY" pause "MORNING" pause "OK".

to open the electronic diary at the entry for next Friday morning.

This sort of verbose input allows the user to interact with the machine in a more "human" manner.

Most of the features described above cannot be implemented in the Voice Function Key mode where the application does not even know of the presence of the VIS.

The size of the vocabulary available in the Voice Driven Application mode is also much more flexible than the Voice Function Key mode. Instead of being restricted to 32 entries, it is in theory "unlimited".

The limiting factors are the constraints of machine memory size and acceptable performance. (The training utility allows up to 9,999 words in a single vocabulary file).

This does not mean that the application has an unlimited pool of words active at the same time. It only can have a maximum of 63 words active at any one time, but can switch other words and vocabularies (up to 30) in and out to suit the context of the application.

Limiting of words in this way to within a defined situation is similar to what happens in person to person communications where we talk within the context of one subject or another. The conversation, like a particular command sequence in an application, generally only uses/requires a limited vocabulary.

The applications writer has to provide a vocabulary file with his Voice Driven Application. The user then has to invoke the training utility (TRAIN) to train the vocabulary, prior to using the application.

As the Voice Driven Application is fully aware of the VIS and can communicate directly with it, the vocabulary loader VOICE is used in a different manner. The format for loading a vocabulary file is similar to the Voice Function Key mode, but the last parameter has a slightly different meaning.

Instead of being the number of words within the vocabulary, it signifies the size of memory (number of buffers) allocated in memory for storing word models at any one time. This number has to be specified by the application writer and is related to the size of memory available on the Portable. The format of the vocabulary loader for a Voice Driven Application is as follows:

A>VOICE <filename> <buffer size>

Keyboard

The design of the Portable Keyboard is slightly different from the keyboards found on other business micros; being a full function keyboard (92 keys) which is linked to the Systems Unit by infra-red and which also incorporates a real time clock calendar (implemented in software).

The key layout is divided into a number of well defined sections. These are, looking from left to right across the key tops:

1. The QWERTY section which includes cursor, scroll and general editing keys. This is an identical layout to the one found on the Apricot pc/xi range of computers.
2. A calculator keypad.
3. 10 general/fixed fuction keys.

These keys are square in design and feature a slightly sculptured keytop to ensure accurate user action.

Four machine function keys are located above the keyswitch array and are of an entirely different design. They are slightly recessed to avoid inadvertent user action.

The Keyboard is designed to be used with its spring-loaded feet extended. Buttons for releasing the feet from their storage position are provided on the side of the Keyboard.

The major advantage of using the infra-red link for transmission of keyboard data is that the user is free to site his Keyboard in the general vicinity of the Systems Unit but not necessarily directly in front of it. (Maximum practical distance for using the infra-red Keyboard is specified at up to 2 metres away from the Systems Unit).

To avoid the possibility of interference in multiple machine environments, a "light-pipe" is available for linking the Keyboard and Systems Unit together. This is a section of fibre optic cable which directs the infra-red keyboard transmissions to the receiver circuits of the parent Systems Unit.

To improve system reliability and ensure that the BIOS does not misinterpret data transmitted from the Keyboard, the keycode data is encoded using Hamming codes prior to transmission. This is an error correction/detection encoding technique which allows the BIOS to correct and detect errors in the transmitted key data.

The keycodes are transmitted in serial packets of data, each packet consisting of 32 bits. The information contained in the transmission packet signifies the X-Y co-ordinate of the pressed key and the key status. The key status identifies whether the key pressed is:

1. A single standard (normal) keystroke.
2. Shifted (SHIFT key + key pressed).
3. A control key sequence (CONTROL + key pressed).
4. In Auto-repeat mode (key was the last key to be transmitted and is being held down).

The use of keycodes rather than using the ASCII equivalent to represent the key(s) makes it particularly easy for the programmer to redefine the keycode. Support in the BIOS is provided to allow this to be done by simply loading a new keyboard table into RAM and modifying a pointer to point to it. A default keyboard table is stored in ROM.

Not all keys can be reassigned by the applications programmer. Certain of the keys are designed to perform specific functions and are therefore masked off by the BIOS and processed in an entirely different manner. This includes the TIME/DATE key and the four button keys RESET, REPEAT RATE, SET TIME and KB LOCK.

The TIME/DATE key causes the time and date information stored internally within the Keyboard to be transmitted to the Systems Unit. This is used by the ROM BIOS to update the BIOS internal clock, (as used by MS-DOS for its time and date stamp). The time and date data is supplied to the Systems Unit in 15 separate contiguous data packets following the TIME/DATE keycode packet.

The key also serves another function at machine switch on, where it initiates the boot loading sequence, if a bootable disk is within the disk drive.

The function of the RESET key is self-explanatory, being the system reset key. It generates a hardware reset in the Systems Unit and must be held down for approximately one second before it functions. The delay is implemented to prevent the user accidentally resetting the system.

The REPEAT RATE key is a toggle switch which allows the user to set the auto-repeat rate of the keys to either one of two values; a fast or a slow repeat rate. (The repeat rate is the rate the keyboard transmits the keycode to the Systems Unit, when a key is held down).

The SET TIME key is used to adjust the real time clock/calendar software within the keyboard. It can be actioned by the user anytime (before or after the system boot). Pressing the key displays a prompt on the 25th line of the display in the following format:

HH:MM DD/MM/YY

The user resets the time and date within the keyboard by typing in numerical values only (e.g. typing 1000011285 sets the keyboard clock to 10 am, 1st Dec 1985).

The key does not send the updated time and date information to the ROM BIOS. This function is actioned by the TIME/DATE key as described above.

The KB LOCK key is a toggle key which enables the user to deactivate the effect of all keys apart from RESET, SET TIME, TIME/DATE and KB LOCK itself, (i.e. it locks out the keyboard). Pressing the key again informs the BIOS to restore action to all the keys.

Two other special keys on the Keyboard are the CALC function (obtained by SHIFT + F4) and VOICE (obtained by SHIFT + F5). These can be redefined by applications software if required, but should generally not be reconfigured.

The CALC function key can be used prior to boot and can be also made available during applications or at the operating system level, to initiate the BIOS calculator software.

The calculator display appears on the 25th line of the display screen. The calculator keys are formed by:

1. The numeric keypad (1 to 9, the mathematical function keys, decimal point and ENTER).
2. The CLEAR key.
3. The function keys, STORE, RECALL, M+, M—.
4. The CALC key.

After boot an extra calculator key is available to the user. This is the function key, SEND (CONTROL + F5). It enables the user to send the results or operands of a calculation to the cursor position on the screen.

The VOICE function key acts as a toggle switch to enable/disable the voice driver. This allows the user to activate or deactivate the speech recognition software as required.

The Keyboard is powered by four AA batteries, which are located behind a panel on the base of the Unit. These provide enough power to keep the Keyboard operational (under normal everyday usage) for approximately 6 months.

To cater for custom keyboard layouts (Dvorak, the French style AZERTY format, or any other foreign language layout), the key tops have been designed to be easily removed and repositioned. Applying slight leverage underneath a keytop releases it from its normal location.

Because the majority of the keyboard is software configurable, the programmer can reassign the keyboard to match a different layout simply by installing a new keyboard table, as described previously.

Printer Support

The Portable has two ports available for connecting printers; a Centronics port for parallel printers and an RS232C port which can be used for serial printers.

The Centronics port connections support the more common handshake signals normally required/ supplied on the majority of parallel interface printers:

1. Data Strobe
2. Busy
3. Printer Select
4. Fault
5. Paper Empty

A description of the facilities provided by the RS232C port for serial printers and various communications device is detailed below.

Communications

A sophisticated RS232C communications port is provided as standard equipment for general purpose communications (via acoustic couplers, modems, direct connection to other micros, etc).

It can also be configured for driving various printing devices (serial line printers, plotters, typesetters, etc).

The port can be programmed to operate in both asynchronous and synchronous modes, with the programmer having independent control over transmit and receive baud rates. These can be either set to the same value or set to operate with different rates for transmit and receive as required.

The baud rates can be selected under software control to be driven by an internal timer circuit at any of the more commonly used values (from 0 to 9.6 Kbaud) for general purpose communications. A higher rate of 19.2 Kbaud can also be used for Apricot to Apricot communications (Portable to Portable, Portable to Apricot pc/xi).

Alternatively, a software switch enables the baud rates to be set by external equipment instead of the internal timer.

The programmer is able to choose from a variety of synchronous modes. These include the bit oriented modes HDLC and SDLC, and the byte oriented modes, Monosync and Bisync.

The control and timing signals available at the RS322 output (formed by a standard 25-pin D-type female connector) are as follows:

1. RTS (Request To Send)
2. CTS (Clear To Send)
3. DSR (Data Set Ready)
4. DTR (Data Terminal Ready)
5. DCD (Data Carrier Detect)
6. TxCK (Transmit Clock)
7. RxCK (Receive Clock)

Two supply outputs (+12V/—12V) are also available on the connector. These are primarily for use by the Apricot Point 7 network.

Other communications facilities available to the Portable are provided by optional Expansion Boards. The Portable is hardware compatible with the Apricot integral Modem and the Apricot LAN card.

The applications-driven Apricot integral Modem provides the user with the facility to communicate over the telephone network via the Portable.

The Modem is a frequency shift keyed (FSK) Modem conforming to CCITT V21 (300 bps full duplex) and CCITT V23 (1200/75 bps full duplex) standards. It has autoanswer capability conforming to CCITT V25 standard, and also incorporates an integral loop disconnect (pulse) autodialler.

Typical applications the Apricot Portable complete with Modem can be employed to do are:

1. Emulation of various computer terminals which are used for communicating to mainframes and minicomputers.
2. Access public and private databases.
3. Transfer files and data between the Portable and any other micro or computer with asynchronous modem facilities available.

The Apricot LAN card with the appropriate network software allows the Portable to be linked into the Apricot Point 32 network and function as a user network station. This provides the Portable with the facility to access all the allocated resources (printers, file space, etc) provided by his local area network.

Expansion

A single Expansion Slot has been designed into the Portable to cater for any optional expansion facilities the user may require. A single slot approach has been adopted instead of multi-slot capabilities to allow the machine to retain its portability aspect.

A high degree of compatibilty has been maintained with the other products within the Apricot pc/xi range of computers. This is such that all existing ACT Expansion boards (Winchester Controller, Modem, RAM cards, etc) can be used within the Portable without any modification to the Expansion Board hardware.

The philosophy for using multiple Expansion boards is different to the one originally adopted on the Apricot pc/xi range of machines. Two approaches are available to the user for increasing the capabilities of the Portable via the Expansion Slot if he has more than one Expansion board.

The first approach is to swap boards as and when required. The plastics for the Portable have been specially designed to allow easy access to the Expansion slot for interchangeability of Expansion boards.

The potential problem of applications software requiring more RAM when using a certain Expansion board is alleviated by the availabilty of the on-board RAM expansion feature of the Portable. (i.e. the manufactured option of 512K).

The second approach is to extend the expansion bus out of the Portable to a separately powered Expansion Unit fitted with multiple Expansion Slots. The Expansion Unit is responsible for re-powering the Expansion bus to meet the drive capability of multiple Expansion Slots.

Specification

Machines:	Two different models, 1 base model + 1 variant. Models differentiated by the size of RAM fitted. The base model contains 256 Kbyte system RAM + 64 Kbyte display RAM. The variant contains 128 Kbyte of display RAM and 512 Kbyte of system RAM.
Processor:	Intel 8086 running at 5 MHz.
Memory:	256 Kbyte System RAM. (Manufacturing option of 512 Kbyte). 64 Kbyte Display RAM. (128 Kbyte if colour option fitted). 32 Kbyte of Boot ROM (expandable to 64 Kbyte).
Disk:	Double-sided MicroFloppy disk drive capable of being used with either 80 track double-sided (720 Kbytes) or 70 track single-sided MicroFloppy disks (315 Kbytes).
Printer Support:	Centronics port and RS232C port.
Comm. Port:	RS232C port capable of being driven in either asynchronous or synchronous modes (Bisync, Monosync, HDLC or SDLC) with selectable baud rates (internally 0 to 9.6 Kbaud; externally set by data communications equipment).
Expansion:	One Apricot pc/xi compatible expansion slot.
Voice Input	Integral speech recognition system (VIS), configurable in one of two modes: 1. Voice Driven Application mode. 2. Voice Function Key mode. In the Voice Function key mode, the size of a vocabulary is limited to 32 words.

In the Voice Driven Application mode, the size and number of vocabularies used is determined by the applications programmer. A maximum of 63 words are allowed to be active at any one time, with the programmer being able to (subject to memory size and acceptable performance):

1. Use up to 30 different vocabularies with a maximum of 9,999 words in each vocabulary.
2. Dynamically switch in and out; single words within a vocabulary; whole vocabularies.

Keyboard: Full function "soft" keyboard incorporating QWERTY layout, calculator keypad, four machine specific function keys, and a bank of ten "fixed/general" function keys. Linked to the Systems Unit by infra-red. (Optional light-pipe connection for multi-machine environments).

Sound: Programmable tone/noise generator + integral loudspeaker (Three tone generators, 1 noise source).

Display Features: 1. Base Model

Logic to drive a colour monitor and the integral flat panel display in the following modes:

1) 640 x 200 resolution colour monitor displaying 2 colours simultaneously with the flat panel display in the standard 640 x 200 resolution mode.
2) 640 x 200 resolution colour monitor displaying 4 colours (integral display off).
3) 640 x 256 resolution colour monitor displaying 2 colours simultaneously with the flat panel display in the standard 640 x 200 resolution mode.
4) 640 x 256 resolution colour monitor displaying 4 colours (integral display off).

Default character font of 256 characters down loaded into System RAM. Alphanumeric characters based within a 7 x 7 pixel matrix contained in an 8 x 8 cell.

Default character font of 256 characters downloaded into system RAM. Alphanumeric characters based within a 7 x 9 pixel matrix and contained in an 8 x 10 cell for 256 line modes.

"Soft" font capability.

Software character attributes;

1) Reverse
2) Underline
3) Strikethrough
4) Intensity

2. Variant

Logic to drive a colour monitor and the integral flat panel display in the following modes:

1) 640 x 200 resolution colour monitor displaying 8 colours simultaneously with the flat panel display in the standard 640 x 200 resolution mode.
2) 640 x 200 resolution colour monitor displaying 16 colours (integral display off).
3) 640 x 256 resolution colour monitor displaying 8 colours simultaneously with the flat panel display in the standard 640 x 200 resolution mode.
4) 640 x 256 resolution colour monitor displaying 16 colours (integral display off).

Default character font of 256 characters downloaded into system RAM. Alphanumeric characters based within a 7 x 7 pixel matrix and contained in an 8 x 8 cell for 200 line modes.

Default character font of 256 characters downloaded into system RAM. Alphanumeric characters based within a 7 x 9 pixel matrix and contained in an 8 x 10 cell for 256 line modes.

"Soft" font capability.

Software character attributes;

1) Reverse
2) Underline
3) Strikethrough
4) Intensity

Dimensions: Systems Unit -

Length: 17.7 inches (450 mm)
Width: 6.8 inches (172 mm)
Height: 7.9 inches (200 mm)

Keyboard -

Length: 17.7 inches (450 mm)
Width: 6.6 inches (167 mm)
Height: 1.1 inches (28.5 mm)

Weight: Systems Unit - 10.0 lbs
Keyboard - 2.9 lbs

Power Supply: Either 240V or 110V operation (selected by a configuration switch). Current consumption:

Approximately 600mA - 240V
Approximately 1.2A - 110V

Approvals: (pending)
UL - 114
CSA - C22.2 (No. 154 1983)
BEAB - BS415
FCC - Class B, Part 15, Subpart J

Software Overview 1.2

Contents

Introduction

The control software for the Portable consists of three basic modules; a standard proprietary Disk Operating System (normally MS-DOS) and two BIOS modules; one resident in ROM, the other loaded into RAM at the same time as the operating system. (The BIOS is an acronym for Basic Input Output System).

The ROM based BIOS (hence termed ROM BIOS) consists of a number of basic hardware device drivers (screen, keyboard, disk, etc). These are responsible for controlling all the standard hardware devices within the computer (and also some of the Apricot optional add-on devices, e.g. the Apricot 10 Mbyte MSD).

The drivers in the ROM BIOS are not the only software device drivers supplied with the machine; four other loadable device drivers are also provided as standard software on the release disks, together with a graphics software interface (GSX).

The first of the loadable device drivers is the voice driver (SPEECH.SYS), which provides the software interface for the speech recognition facilities. This is normally an integral part of the Portable operating software and is loaded into the system at boot-up along with MS-DOS if the user wishes to utilise the Voice Input System.

The second loadable device driver is an optional user facility for implementing a RAM disk (RAMDISK.SYS). The user is able to allocate 64K portions of the system RAM to simulate a floppy disk (i.e. a RAM Disk) to greatly enhance system performance.

The format of the entry in the CONFIG.SYS file for this installable device driver requires one argument as detailed below:

DEVICE=RAMDISK.SYS /n

where n represents the number of 64K portions allocated.

Note: A space must be inserted between the RAMDISK.SYS and the backslash.

The system software views the RAM Disk as an extra disk drive and allocates the next free drive designation to it. (i.e. On a single drive system, this would be drive B).

Generally, implementation of the RAM Disk is only feasible on systems employing more than 256 Kbytes of system RAM.

The third loadable device driver is the modem driver (MODEMAPR.SYS). This is also an optional loadable device driver. It provides the programmer with the necessary tools to integrate the communication facilities of the optional ACT integral modem into an application.

The fourth optional loadable device driver is the Mouse device driver (MOUSE.SYS). This is linked into the system to handle all data transmissions from either the ACT infra-red mouse or the MicroSoft serial mouse. It forms an integral part of the graphics software and is also available for use with other applications.

The fifth device driver is the GSX graphics driver. It differs from the other device drivers described above, since it does need to be installed at boot-up. (All the other drivers described above use the MS-DOS facility for installing loadable device drivers by appending an entry to the CONFIG.SYS file). The GSX graphics interface incorporates its own command file (GRAPHICS.EXE) for installing the software.

The function of the GSX graphics interface is to provide the programmer with a machine independent graphics interface.

Details

Applications Interface

On nearly all microcomputers, the applications programmer has a number of choices for integrating his software into the machine's environment. He can do this in any combination of three possible ways as described below:

1. Using the facilities of MS-DOS.
2. Linking into either the ROM BIOS or other device driver routines.
3. Directly accessing the hardware.

MS-DOS

MS-DOS provides the programmer with a high level machine independent interface for applications programs. It allows programs to run on dissimilar machines (e.g. Apricots, IBM PCs, etc), providing no other machine specific features are accessed.

It also permits the programmer to create installable device drivers at the DOS interface level in a consistent manner. These drivers can either define a new device type to be used on an Apricot (e.g. the generic Modem driver, version 2.0 of MODEMAPR.SYS), or replace an existing driver (e.g. keyboard, screen driver, etc).

ROM BIOS

The way the applications programmer links into the Apricot ROM BIOS is via a simple interface, the Apricot Control Device. This provides a standardised method of accessing the BIOS routines and is adopted in the same generic format on all Apricot computers. (It is currently supplied in limited form on the pc/xi range of machines, but is soon to be upgraded into the same specification as found on the Portable and F1).

The Control Device allows the programmer to control basic low-level machine functions without having to resort to accessing the hardware.

If a programmer uses this interface for all features and facilities not available through MS-DOS, it will allow him to produce "portable" applications which will run on all members within the Apricot range of computers (Apricot pc/xis, F1s and Portables).

The Control Device thus provides the programmer with a low level machine independent interface to application programs, which is *compatible* across the range of Apricot microcomputers.

The purpose of the Control Device is to hide the differences in the hardware between various models within the Apricot family. This does not mean that the application writer cannot use the special features which are implemented on one machine but are not available on another.

Inherent in the configuration parameters is data to enable the application programmer to identify which Apricot micro his application software is being run on. The writer can modify his software to use any special feature by first determining the machine and then tailoring the routines accordingly.

Hardware

Direct accesses to the hardware will not produce the desirable goal of machine independent code for the applications programmer.

The hardware components of the Apricot micros are substantially diverse and port addressing is significantly different. Code which writes directly to the hardware will require translation and rewrites for each product within the Apricot range of computers. This will of course make the application totally machine specific.

One area where the BIOS does actually mask out the differences in the hardware is in interrupt support for expansion cards. Even though the interrupt lines on the expansion bus are all wired to the same pins on the expansion board connector throughout the whole range of Apricots, the associated interrupt pointers differ from machine to machine.

To make it easier for the third party hardware vendor to produce compatible boards for the whole range, a software interrupt has been reserved which allows the programmer to set up his interrupt handler vectors and relate them to the physical interrupt line rather than the hardware interrupt pointer.

It will not always be possible for all application programmers to totally ignore the hardware and only use a combination of MS-DOS and the Control Device. Accessing the hardware will be necessary if certain features the programmer wishes to use are not available through MS-DOS or the BIOS (e.g. synchronous communications support via the RS232 port).

Direct accessing to the hardware can cause a few problems, generally associated with contention arising between the BIOS and the application when both are accessing hardware registers which are write-only. (The application and the BIOS would not normally know what has been set up by the other's software, and therefore could overwrite each other's hardware registers). This contention invariably results in the machine crashing.

To alleviate this potential problem, the BIOS maintains copies of certain write-only hardware registers which may be of use to the application programmer. These are stored in RAM and accesible to both the BIOS and the application.

The BIOS only changes bits within the hardware registers which are of interest to the BIOS and always makes a copy of any changes in the copy register. In order to avoid contention, the application should always adopt the same procedure.

Graphics

One of the current growth areas in applications software is in the use of graphics displays. Again, as with standard machine functions, one of the most desirable goals for an applications writer is to be able to produce graphics software that is portable across a whole range of machines.

In order to do this, the applications writer requires a consistent software interface for graphics functions. This is provided by the Digital Research module GDOS which is part of the Apricot implementation of GSX.

The GDOS is a machine independent applications interface to graphics functions and is implemented on all Apricot micros.

It provides the programmer with a standard set of primitive graphics operations enabling him, by using a simple calling procedure to:

1. Draw lines, arcs, pie slices, bars and circles of various styles, and colours.
2. Place text on the screen.
3. Plot points.
4 Fill polygon areas in various styles and colours.
5. Program the colour palette to alter the colours available on a colour monitor.
6. Interpret user input from the keyboard and mouse.
7. Configure the machine to match the desired resolution and colour mode, (e.g. 8 colour graphics on a colour monitor or monochrome graphics on the LCD).

Examples of programs which run under GSX are the utility programs contained within Activity, ACT Sketch and ACT Diary.

The GSX system is based on two modules, the GDOS module from Digital Research and the GIOS (Graphics Input Output System), written by ACT.

The GIOS is the low level hardware interface which forms the bridge between the GDOS and the display hardware. This differs from machine to machine (as does the display hardware) and is not accessible to the programmer.

Different versions of the GIOS have been provided on the Portable to use the various display capabilities. GIOSs have been created to support both the LCD and a colour monitor in the following graphics configurations:

1. 640 x 200 line graphics using 16 colours.
2. 640 x 256 line graphics using 16 colours.
3. 640 x 200 line graphics using 8 colours.
4. 640 x 256 line graphics using 8 colours.
5. 640 x 256 line graphics using 4 colours.
6. 640 x 256 line graphics using 4 colours.
7. 640 x 200 line monochrome graphics using the LCD.

The programmer selects the appropriate GIOS to match his requirements by using a command available through GDOS.

Operating Systems Interface

MS-DOS does not make requests for services by communicating directly with the ROM BIOS. All requests are directed via the RAM BIOS to the Apricot Control Device. The RAM BIOS handles all communications between MS-DOS and the Control Device. It interprets:

1. MS-DOS function requests and translates them into calls to the generic Control Device.
2. Status messages returned from the Control Device and translates them into MS-DOS format.

Using a RAM based BIOS for this translation makes it particularly easy for other operating systems to use the routines within the ROM BIOS.

The only major function a different operating system manufacturer has to do to link into the machine is, to write a different RAM BIOS which performs the same function as the MS-DOS version and load it in together with his operating system at boot-up. This cuts out the time consuming exercise for the operating system manufacturer of having to create his own set of device drivers.

All the necessary details to allow other operating systems to produce generic boot disks (as supplied by ACT for MS-DOS) so that they are compatible across the different products in the range of Apricot microcomputers (e.g. F1s, pcs and xis upgraded with the appropriate BIOS) are included in later chapters.

MS-DOS

The features of Microsoft's MS-DOS are widely known, currently being the most widely used 16-bit microcomputer operating system.

The initial release of software supplied with the Apricot Portable is version 2.11. This will inevitably be upgraded to MS-DOS 3 in the near future, which features "hooks" for linking into the MS-NET networking software. On its own without the MS-NET module, DOS 3 is virtually identical in functionality to MS-DOS 2.11.

MS-DOS 2.11 is an extension of the widely used MS-DOS 2.0 which hailed the introduction of the enhanced operating system features of installable device drivers and tree-structured directory support. The main difference between these two versions is that DOS 2.11 provides support for international languages and uses 8-bit character codes in files instead of 7-bit.

Different versions of DOS 2.11 are available complete with MS-DOS utilities, which support foreign languages such as French and German.

ROM BIOS

The ROM BIOS has been discussed in detail in the Applications Interface section above with reference to the function of the Control Device. Instead of repeating this information, a brief summary of its salient points are detailed below. This is then followed by an introduction to the standard device drivers included within the ROM BIOS.

Besides consisting of the series of basic hardware device drivers, the ROM BIOS also contains the generic applications interface, termed the Apricot Control Device. This is implemented on all Apricot machines, (currently as a limited sub-set on the Apricot pc and xi machines but these machines are soon to be upgraded to the same interface specification as the Portable and F1).

The routines in the ROM BIOS are accessible to the application programmer via the control device interface. It provides the application programmer with an extremely easy and efficient way to access various low level routines, not normally available using calls to MS-DOS alone, thus allowing the programmer greater control of machine functions.

The programmer can access the Control Device in one of two ways.

The first method is designed to suit assembly language programmers and is similar to a MS-DOS function request. The programmer loads the 8086 registers with:

1. Information to specify the device to be accessed (e.g. Keyboard driver).
2. A command (e.g. initialise)
3. Data as required.

A call is then made to the Control Device by generating the interrupt FCH.

The second method is designed to support higher level languages such as BASIC. The programmer accesses the Control Device by assembling a series of parameters (specifying the device, command and data as required) and passing them onto the stack by performing a far call to 0600H.

Drivers

The ROM BIOS contains the following standard device drivers, listed below. The actual function of each driver is indicated by their titles.

1. Keyboard Driver
2. Screen Driver
3. Disk Driver
4. Parallel Port Driver
5. RS232 Driver
6. Clock Driver
7. Winchester Driver

Keyboard Driver

This routine receives all data transmitted to the machine via the infra-red input. This includes keyboard and mouse data.

Decoded mouse data is not handled by the keyboard driver. It is immediately passed onto another routine via an interrupt. The mouse data handling routine may be the loadable mouse device driver, or any other routine installed by the application writer.

Keyboard data is always initially analysed for any special key depressions such as TIME/DATE, KB LOCK, SET TIME, REPEAT RATE. These keys are filtered off and sent off to the appropriate ROM BIOS routine to action a specific user function. They are therefore not accessible to the applications writer.

All other keys are converted to an Apricot compatible keycode (termed a downcode), which is normally used to select an entry from a keyboard table. The selected entry is then usually passed to MS-DOS via an 80 byte queue.

The keyboard table occupies a minimum of 1K of memory space and can be either the default keyboard table in ROM or any other keyboard table loaded into RAM by the programmer. The use of a software keyboard table allows the programmer to translate a user key depression to any code or sequence of codes as required.

A simple mechanism enables the programmer to specify the keyboard table in use. This is achieved by modifying a pointer (the active key table pointer) to point to the start of the desired table.

A KEYEDIT utility is supplied with the system software to allow the user/programmer to either create new keyboard tables or modify an existing one.

The format of the keyboard table used on the Portable is compatible with the format of the key tables used on all other Apricot computers (F1s, pcs, xis, etc). It consists of four sections.

The first three sections contain the entries for keys in normal mode (single keystroke), shifted mode (key + SHIFT key), control mode (key + CONTROL key). The last section defines an area of string keys. This section of the table is accessed by programming the entries in the three other sections to act as a pointer into the string area.

Facilities are provided within the Control device interface to alter the way the driver handles the keycodes. The programmer has various options available, for manipulating keycode data such as:

1. Handling downcodes directly, missing out the translation process provided by the keyboard table.
2. Analysing and extracting keycodes from the 80 byte queue, and processing the data as required.
3. Placing data into the queue.
4. Checking driver status, sounding the bell, etc.

Interrupt support is also available to enable the application programmer to vector off keycode data to his own routines, as required.

Screen Driver

The features of the Screen Driver provide the applications programmer with comprehensive control of the LCD and an optional colour monitor. The basis for controlling the displays is via ESCape sequence support and calls to the Control Device.

The screen modes available through the driver are as follows:

1. Standard 80 column by 25 row character based display on the LCD module with the following attributes in normal or reverse video:

   Underline
   Strikethrough
   Intensity

   This is termed the *Apricot compatible* mode, since it is available in the same format on all current machines.
2. 40 column by 25 row character based display on the LCD in normal or reverse video.
3. Standard 80 column by 25 row character based display on a colour monitor in monochrome (any two colours from 16). Attribute support is as described for mode 1 (normal or reverse characters with underline, strikethrough and intensity attributes). This is also classed as the Apricot compatible mode.
4. 80 column by 25 row character based display in multi-colour on the colour display. The number of colours available is dependent on the amount of display RAM fitted; up to eight colours from 16 on the 128K RAM version; up to four colours from 16 on the 64K RAM version. Standard monochrome attributes are not supported. Attributes are generated by varying the foreground and background colour of the characters.

Driving both the LCD and the colour display simultaneously with data is not available.

The colour display modes are in one of two different scan line resolutions; 200 or 256. These are designed to match the display resolutions available on an ACT colour monitor when it is connected to either of the two mains supply input frequencies used in the majority of countries throughout the world.

The 200 line mode is primarily for use in the USA and other countries using 60 Hz mains supply lines. The 256 line mode is for use in countries using 50 Hz mains supply input (UK, European, etc).

Two fonts with 256 identical characters per font are normally downloaded into the system RAM at boot-up.

One of the fonts is based upon an 8 x 8 character cell and is available for use on the LCD and colour monitor in 200 line mode. The second font is based upon an 8 x 10 character cell and is for use on the colour monitor in the 256 line mode. The screen driver performs automatic selection of the correct font according to the line resolution mode selected by the application programmer.

A FONTEDIT utility is supplied with the system software to allow the user/programmer to either create new character fonts or modify an existing one.

The programmer can also dynamically change from font to font during run-time (if required). This is achieved by simply modifying a pair of font pointers, which specify the start of the currently active font.

A comprehensive set of ESCape sequences are inherent within the screen driver including a sub-set of the ANSI standards. These provide the programmer with:

1. Control of screen character attributes such as intensity, underline, etc in monochrome modes (LCD or colour display).
2. Colour selection on the colour display. This includes; background and foreground screen colour in monochrome mode; background screen colour plus background and foreground colours on a per character basis in multi-colour modes; independent programming of the palette for other application usage.
3. Cursor control routines.
4. Word Processing primitives, such as Insert line, Delete line, etc.
5. Facilities for changing the screen environment, e.g. to 40 columns, 4 colours etc.
6. Windowing functions.
7. Support for hard copy.

To make it easy for the programmer to build character images on either of the bit-mapped displays, the driver supports virtual screen images located in RAM. Two virtual screens are supported, one for the LCD, one for the colour monitor.

Each character on the virtual screen is represented by a single word. The lower byte is the ASCII character code; the upper byte either signifies the character attributes or if a multi-colour mode, the foreground and background colours for the character.

The programmer accesses these screens via the control device interface. He can use these to build up character images in the background, and then command the driver to repaint the image on the appropriate bit-mapped display from the virtual screen.

Other support features provided by the control device allow the programmer to update individual characters on the LCD or colour screen with the appropriate attribute/colour selection as required.

Disk Driver

This driver has been primarily designed to provide the necessary support for MS-DOS disk operations to the floppy disk drive. The only entry point to the driver is via the Control Device interface.

The driver is configured to support both 70 track single-sided and 80 track double-sided disks, enabling multiple sector reads and writes to either type. It also provides calls for linking in a formatting program.

The applications writer can use the control device calls for checking disk status, and if so desired can perform read and writes to absolute disk sectors instead of using the MS-DOS file structure.

Parallel Port Driver

The parallel port driver is used to drive the Portable's Centronics port, thus providing applications support for sending data to parallel printers and plotters. The only method provided for accessing the driver, is via the Control Device interface.

Facilities provided by the Control Device allow the programmer to:

1. Examine/control the state of the Centronics interface handshaking signals.
2. Send characters to the driver's print buffer (the length of which is 2K bytes).
3. Clear the print buffer of characters, test for space in the buffer, etc.

It also provides a call to re-route characters to a serial printer via the RS232 port.

RS232 Driver

This driver provides various support features to allow the programmer to drive the RS232 port asynchronously. The programmer's method of accessing these routines is via the Control Device interface.

The following features are available through the Control device interface for supporting asynchronous communications:

1. Full duplex operation with variable length buffering available on both the transmit and receive paths (1 to 512 bytes).
2. Control of most of the commonly used transmit and receive baud rates.
3. Selectable parity and stop bits.
4. Control and status monitoring of the modem control lines; DTR, CTS, RTS. DSR and DCD.
5. XON/XOFF flow control.
6. Primitive teletype functions (e.g. automatic transfer of nulls after carriage return, etc).

Other features provided by the driver are:

1. Automatic vectoring of receive data to an installed mouse device driver to enable handling of data from a serial mouse.
2. Interrupt support to allow the hardware (Z80 SIO) to be driven directly by an application without having to resort to writing and reading to port addresses.

Clock Driver

This driver is driven by a hardware timer interrupt which is generated on a regular 20 ms cycle. The routine is responsible for maintaining the clock/calendar for the time and date stamp used by MS-DOS. This is updated when the user presses the TIME/DATE key.

It also handles various timing routines as required by the floppy disk drive, winchester, cursor control routines, printer routines, etc.

The application programmer can use the regular 20 ms cycle to implement his own timer related functions. He can link into the cycle by simply installing his own routines at a location specified by a software interrupt.

Winchester Driver

This driver is provided to support add-on Winchester devices such as the Apricot MSD. As with the floppy disk driver, the main function of the driver is to provide the interface between MS-DOS and the disk drive.

The driver enables up to two Winchester drives to be supported in a single system. The Winchester drives can be of different capacities (e.g. a 5 Mbyte and a 10 Mbyte).

The applications writer can use the control device calls for checking disk status, and if so desired can perform read and writes to absolute disk sectors instead of using the MS-DOS file structure.

There are no routines in the driver for linking in formatting programs.

Options 1.3

Contents

Introduction

The basic configuration of the Portable can be altered by the addition of various options to reflect the differing requirements of the user. Thes options can be broken down into two categories:

1. Factory fitted options.
2. ACT options available from a dealer.

Factory fitted options

Factory fitted options define the various models within the Apricot Portable range of computers. These consist of one base model and one variant. The differences between the models only occur in the area of the display RAM and the System RAM.

The base model is fitted with 64K of display RAM and incorporates 256K of system RAM. The variant incorporates 128K of display RAM and has 512K of system RAM.

Dealer Supplied Options

At present there are a number of optional facilities which can be added to the basic configuration of the members within the Portable range of microcomputers. These are as follows:

1. Colour monitor.
2. RAM Expansion Boards.
3. Modem Board.
4. LAN Board.
5. Mouse.
6. Apricot MSD.

Colour Monitor

The colour monitor plugs into a 9-way D-type connector behind the Expansion cover. It provides the Portable with the facility for displaying text and graphics in colour.

The colour monitor is a 16-colour IRGB monitor, which is configured to run in 640 x 200 line display mode when using 60Hz mains supply input frequency and 640 x 256 line display mode on a 50 Hz mains supply.

Support in the BIOS allows the applications programmer to display text-based applications in either monochrome (any two colours from 16) or using a multi-colour mode (4 colour mode - any 4 colours from 16 or 8 colour mode - any eight colours from 16, if the colour RAM option is fitted).

Graphics support provided by the GSX interface allows the programmer to drive the monitor in either a four colour mode (using 4 colours from 16) or, if the colour option RAM is fitted, in sixteen colour mode using the full colour range on the monitor.

RAM Expansion Boards

The RAM Expansion Boards are single board Expansion cards. The boards are available in three different memory sizes, 128 Kbyte, 256 Kbyte and 512 Kbyte. The boards are only of use in the model which incorporate 256 Kbytes of System RAM.

In these models, the appropriate board can be installed to increase the standard 256 Kbytes to any one of the following values:

1. 384 Kbytes.
2. 512 Kbytes.
3. 768 Kbytes.

Modem Board

The Apricot Modem is an integrated hardware and software communications package, which provides the Portable with the facility to transmit and receive data via the Public Switched Telephone Network (PSTN).

The Modem communications package is provided as follows:

1. The Modem hardware, which fits internally within the Portable utilising the Expansion Slot.
2. The Modem device driver software which is supplied as a loadable device driver which is part of the release software.

The Modem is driven via an applications software package interacting with the Modem device driver. This allows the programmer to define the particular service or use, the Apricot Portable/integral Modem combination is to be configured for.

Both the hardware and the software device driver have been specifically designed to allow the Apricot/Modem combination to operate as a multi-purpose communicating microcomputer with a vast and diverse range of differing capaabilities, as defined by an applications program.

Typical applications for the Apricot complete with Modem are detailed below:

1. Emulation of various computer terminals which are used for communicating to mainframes and minicomputers.
2. Act as an interface to British Telecom's viewdata services. This includes the public viewdata service Prestel, or any of the private viewdata services which are protocol compatible with Prestel. Details of Prestel are widely known. The less known service, private viewdata, is operated by large organisations for dissemination of information from a private data base to dealers and clients. e.g. British Leyland's dealer information service.
3. General purpose networking for transferring files and data between the Apricot and any other computer with asynchronous modem facilities available. Communications are not restricted in terms of distance. Both long distances up to thousands of miles (via the public telephone network), or even short distances within the confines of a building (limited local area network capability via a PABX), can be easily accommodated.

4. Function as a repertory dialler. (i.e. A telephone management system which provides automatic dialling of telephone numbers, selected from an internal directory for either voice or data connection).

The Portable/Modem combination is not limited in its connection to a telephone network; it can be connected directly to the network or indirectly through the majority of PABXs with loop disconnect dialling facilities.

Connecting the Portable fitted with the Modem into the telephone system is a simple operation. The Modem is fitted with a "flying lead" terminated with a series 600 plug. The Portable thus retains its' transportability feature being easily connected anywhere on the PSTN by way of a standard series 600 socket.

LAN Board

The Apricot LAN Board is an Expansion Board, which allows the Portable to be linked into the Point 32 local area network as a workstation. This immediately provides the user with access to the resources allocated on the network (large capacity Winchester storage facilities, shared files, shared software, network printers, etc).

To link into the network requires both hardware and a software package (supplied with the network). The hardware consists of the LAN Board and a simple jack plug connection for linking into the network.

The software for the point 32 network is based upon Microsofts' MS-DOS 3.06 plus the MS-NET networking module. This provides the front end for both the user and the applications programmer.

The lower level communication mechanism for the network is based upon the Corvus Omninet. This is a 1 Mbit/s bit-oriented synchronous (SDLC style) transmission system which employs a carrier-sense multiple access/collision avoidance protocol to ensure the integrity of data transmissions.

A network software device driver (often referred to as the transport layer) is provided to link the Microsoft modules to the low level Corvus Omninet System.

Infra-red Mouse

The Mouse for the Portable is identical to the Mouse for the F1 (apart from the colour of the plastics). It has been designed to be used either as a Mouse (by tipping it forward and rolling it along the desk), or as a tracker ball (keeping the Mouse stationary and moving the ball by finger movements).

The Mouse is normally employed for cursor movement control and menu selection in graphics environments, but can be used within other applications as required.

A mouse device driver is supplied with the standard release software to allow applications to use the features and facilities of this device. This is an installable device driver which is loaded into the system using the MS-DOS CONFIG.SYS file mechanism.

The Mouse uses infra-red technology in a similar way to the Keyboard. As with the Keyboard, the Mouse can be sited within the vicinity of the Portable but does not necessarily have to be directly in front of it. (The front edge of the mouse must of course point at all times during usage in the general direction of the front of the machine). The maximum practical range of the Mouse is specified at 2.5 metres away from the Systems Unit.

To avoid the possibility of interference in multiple machine environments, a "light pipe" is also available for linking the Mouse and Systems Unit together. This is a section of fibre optic cable (similar to the Keyboard cable) which directs the infra-red Mouse transmissions to the receiver circuits of the parent Systems Unit.

A two-position switch is located on the base of the unit. This should be set to the position towards the rear edge if using the light-pipe and the other posion if not. The function of the switch, is to turn off one of the infra-red transmitting LEDs to conserve battery power.

To improve system reliability and ensure that the BIOS interprets the data transmitted from the Mouse correctly, the Mouse data is encoded using a similar format as used for the Keyboard. This employs a four byte synchronous data transmission format with each data byte encoded with Hamming codes.

Mouse data is transmitted in serial packets of data, with each packet consisting of a 32 bit code sequence. The information contained in the packet signifies the relative movement of the Mouse from its previous position, and the state of the two Mouse buttons (pressed or not pressed).

Apricot MSD

This device provides the Portable with instant access to a large capacity (10 Mbyte) Winchester Disk. It is supplied as three items; a Winchester Controller Board, a Winchester Disk and a small power supply unit. The Winchester Controller Board plugs into the Portable's Expansion Slot, the other two items are mounted externally to the Systems Unit.

The Winchester drive is supplied pre-formatted complete with system tracks. It is configured as a single volume (drive ***A***) to take full advantage of the tree-structured directory features of MS-DOS 2.11 and its future derivatives. (The floppy disk drive in a single Winchester system is automatically re-assigned as drive ***B***)

Support for a Winchester is inherent in the standard ROM BIOS. All the user has to do to use the Winchester is install the components correctly and switch on.

Included in the initialisation routines of the ROM BIOS is a routine which checks for the existence of a Winchester Controller Board. If present, it checks the Winchester Disk Drive to determine its size.

At the end of the initialisation sequence, the ROM BIOS displays the startup screen. If a Winchester is present, this is slightly modified from the standard display, to include the size of the Winchester Disk.

At the start of the boot sequence, the ROM BIOS first checks the floppy disk drive for a bootable disk. If not present, the machine boots automatically from the Winchester Disk, providing the user with instant access to a large non-volatile storage medium.